

CLAIMS

2 1. An initiation assembly for a pyrotechnic device, the initiation assembly
3 comprising:

4 an initiator that ignites in response to receipt of an activation signal; and
5 a retainer coupled to the initiator, the retainer comprising at least three splines
6 shaped to mate with at least one rib of a connector such that the connector is engageable
7 with the retainer in at least three orientations to enable conveyance of the activation
8 signal from the connector to the initiator, wherein the splines and the rib mesh to prevent
9 rotation of the connector between the orientations.

10
11 2. The initiation assembly of claim 1, wherein the splines are disposed on an
12 outside diameter of the retainer.

14 3. The initiation assembly of claim 1, wherein the splines are disposed on an
15 inside diameter of the retainer.

17 4. The initiation assembly of claim 1, further comprising a body attached to
18 the retainer such that the body encircles at least a portion of the initiator.

20 5. The initiation assembly of claim 4, wherein the retainer and the body are
21 each constructed of polymeric materials, wherein the retainer is ultrasonically welded to
22 the body.

1 6. The initiation assembly of claim 4, wherein the initiator comprises a center
2 pin, a header eyelet encircling at least a portion of the center pin, a cup welded to the
3 header eyelet to provide a hermetic seal, a bridge wire that electrically couples the center
4 pin and the header eyelet together, and a quantity of ignition material positioned to ignite
5 in response to combustion of the bridge wire.

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7 7. The initiation assembly of claim 6, further comprising a cover attached to
8 the body to electrically insulate the initiator from an inflator housing.

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10 8. The initiation assembly of claim 1, further comprising a collar disposed to
11 encircle at least a portion of the retainer, wherein the collar is shaped to be retained
12 within a housing of the inflator.

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14 9. The initiation assembly of claim 1, wherein the retainer is shaped to
15 interchangeably interlock with a nonremovable connector and with a removable
16 connector comprising a main body and a locking bracket movable with respect to the
17 main body between an unlocked position in which the connector is removable from the
18 retainer and a locked position in which the connector is not removable from the retainer.

1 10. An initiation assembly for a pyrotechnic device, the initiation assembly
2 comprising:

3 an initiator that ignites in response to receipt of an activation signal;

4 a body that encircles at least a portion of the initiator; and

5 a retainer integrally formed with the body, the retainer comprising at least three
6 splines shaped to mate with at least one rib of a connector such that the connector is
7 engageable with the retainer in at least three orientations to enable conveyance of the
8 activation signal from the connector to the initiator, wherein the splines and the rib mesh
9 to prevent rotation of the connector between the orientations.

10
11 11. The initiation assembly of claim 10, further comprising a collar disposed
12 to encircle at least a portion of the retainer and the body, wherein the collar is shaped to
13 be retained within a housing of the inflator.

14
15 12. The initiation assembly of claim 11, wherein the collar comprises a first
16 piece and a second piece attached to the first piece, wherein the body is insert molded
17 into engagement with the first piece.

1 13. An inflation assembly for an airbag module for protecting an occupant of a
2 vehicle from impact, the inflation assembly comprising:
3 a connector that delivers an electric activation signal; and
4 an inflator comprising a receptacle shaped to receive the connector in any of at
5 least three orientations in a manner that prevents rotation of the connector between the
6 orientations to enable conveyance of the activation signal from the connector to the
7 inflator, wherein the inflator produces inflation gas in response to receipt of the activation
8 signal.

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10 14. The inflation assembly of claim 13, wherein the receptacle comprises at
11 least three splines disposed to mate with at least one rib of the connector.

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13 15. The inflation assembly of claim 14, wherein the inflator comprises an
14 initiator that ignites in response to receipt of the activation signal, wherein the receptacle
15 comprises a retainer attached to the initiator to retain the connector, the retainer having a
16 generally annular shape, wherein the splines are formed on an outside diameter of the
17 retainer.

18

19 16. The inflation assembly of claim 14, wherein the inflator comprises an
20 initiator that ignites in response to receipt of the activation signal, wherein the receptacle
21 comprises a retainer attached to the initiator to retain the connector, the retainer having a
22 generally annular shape, wherein the splines are formed on an inside diameter of the
23 retainer.

1 17. The inflation assembly of claim 14, wherein the inflator comprises a
2 housing, wherein the receptacle comprises a collar anchored in the housing to retain the
3 connector, wherein the splines are formed on an inside diameter of the collar.

4

5 18. The inflation assembly of claim 14, wherein the receptacle comprises a
6 washer disposed to retain the connector, wherein the splines are formed on an inside
7 diameter of the washer.

8

9 19. The inflation assembly of claim 14, wherein the inflator comprises a
10 housing shaped to retain the connector, wherein the splines are formed on an inside
11 diameter of the housing.

12

13 20. The inflation assembly of claim 14, wherein the receptacle is a first
14 receptacle and the connector is a first connector, the inflator further comprising a second
15 receptacle comprising at least three splines disposed to mate with at least one rib of a
16 second connector, wherein the splines of the first and second receptacles are configured
17 differently from each other to prevent insertion of the first connector into the second
18 receptacle and to prevent insertion of the second connector into the first receptacle.

19

20 21. The inflation assembly of claim 14, wherein the receptacle comprises at
21 least twelve splines arrayed in a circle.

1 22. The inflation assembly of claim 13, wherein the receptacle comprises a
2 geometric shape and the connector comprises a corresponding geometric shape sized to
3 fit within the geometric shape of the receptacle.

4

5 23. The inflation assembly of claim 13, wherein the inflator comprises an
6 initiator that ignites in response to receipt of the activation signal, the initiator comprising
7 a center pin, a header eyelet encircling at least a portion of the center pin, a bridge wire
8 that electrically couples the center pin and the header eyelet together, a quantity of
9 ignition material positioned to ignite in response to combustion of the bridge wire, and a
10 cup welded to the header eyelet to provide a hermetic seal.

11

12 24. The inflation assembly of claim 23, wherein the inflator further comprises
13 a body that at least partially encircles the header eyelet and a cover attached to the body
14 to electrically insulate the initiator from a housing of the inflator.

15

16 25. The inflation assembly of claim 24, wherein the body is insert molded
17 around the header eyelet and the cover.

18

19 26. The inflation assembly of claim 24, wherein the cover is ultrasonically
20 welded to the body.

21

22 27. The inflation assembly of claim 24, wherein the cover is snapped into
23 engagement with the body.

1 28. The inflation assembly of claim 24, wherein the inflator comprises a
2 housing, wherein the body is shaped to be retained directly by the housing.

3

4 29. The inflation assembly of claim 24, wherein the inflator comprises a
5 housing and a collar shaped to be retained by the housing.

6

7 30. The inflation assembly of claim 29, wherein the collar comprises a first
8 piece and a second piece attached to the first piece, wherein the body is insert molded
9 into engagement with the first piece and is integrally formed with a retainer attached to
10 the initiator to retain the connector.

11

12 31. The inflation assembly of claim 29, wherein the collar is formed of a metal
13 shaped by stamping.

14

15 32. The inflation assembly of claim 29, wherein the inflator further comprises
16 a washer disposed generally between the collar and the body to restrict relative motion
17 between the collar and the body due to deformation of the body.

18

19 33. The inflation assembly of claim 29, wherein the inflator further comprises
20 a washer, wherein the body is insert molded into engagement with the washer to restrict
21 relative motion between the collar and the body due to deformation of the body.

1 34. The inflation assembly of claim 24, wherein the body is press fit into place
2 to prevent moisture entry into the inflator and inflation gas exit out of the inflator through
3 a region encircling the body.

4

5 35. The inflation assembly of claim 24, wherein the inflator comprises an o-
6 ring encircling the body to prevent moisture entry into the inflator and inflation gas exit
7 out of the inflator through a region encircling the body.

8

9 36. The inflation assembly of claim 24, wherein the inflator comprises an
10 annular ridge disposed to press into the body to prevent moisture entry into the inflator
11 and inflation gas exit out of the inflator through a region encircling the body.

12

13 37. The inflation assembly of claim 24, wherein the receptacle comprises a
14 retainer ultrasonically welded to the body to retain the connector, the retainer having a
15 generally annular shape.

16

17 38. The inflation assembly of claim 13, wherein the connector is shaped to
18 interlock nonremovably with the receptacle.

19

20 39. The inflation assembly of claim 13, wherein the connector comprises a
21 main body and a locking bracket movable with respect to the main body between an
22 unlocked position in which the connector is removable from the receptacle and a locked
23 position in which the connector is not removable from the receptacle.

1 40. The inflation assembly of claim 39, wherein the connector further
2 comprises a shunting bar movably disposed within the main body to prevent transmission
3 of the activation signal by the connector when the locking bracket is in the unlocked
4 position, wherein the receptacle comprises a shunting clip disposed to prevent receipt of
5 the activation signal by the initiator when the connector is disengaged from the
6 receptacle.

1 41. An airbag module for protecting an occupant of a vehicle from impact, the
2 airbag module comprising:

3 an electronic control unit that produces an electric activation signal in response to
4 detection of a collision involving the vehicle;

5 a connector coupled to the electronic control unit to receive the electric activation
6 signal;

7 an inflator comprising a receptacle shaped to receive the connector in any of at
8 least three orientations in a manner that prevents rotation of the connector between the
9 orientations to enable conveyance of the activation signal from the connector to the
10 inflator, wherein the inflator produces inflation gas in response to receipt of the activation
11 signal; and

12 a cushion disposed to receive the inflation gas and to inflate in response to receipt
13 of the inflation gas to cushion impact of the occupant with an interior surface of the
14 vehicle.

15

16 42. The airbag module of claim 41, wherein the receptacle comprises at least
17 three splines disposed to mate with at least one rib of the connector.

18

19 43. The airbag module of claim 42, wherein the inflator comprises an initiator
20 that ignites in response to receipt of the activation signal, wherein the receptacle
21 comprises a retainer attached to the initiator to retain the connector.

1 44. The airbag module of claim 41, wherein the inflator comprises an initiator
2 that ignites in response to receipt of the activation signal, the initiator comprising a center
3 pin, a header eyelet encircling at least a portion of the center pin, a bridge wire that
4 electrically couples the center pin and the header eyelet together, a quantity of ignition
5 material positioned to ignite in response to combustion of the bridge wire, and a cup
6 welded to the header eyelet to provide a hermetic seal.

7

8 45. The airbag module of claim 44, wherein the inflator further comprises a
9 body that at least partially encircles the header eyelet and a cover attached to the body to
10 electrically insulate the initiator from a housing of the inflator.

11

12 46. The airbag module of claim 45, wherein the receptacle comprises a
13 retainer ultrasonically welded to the body to retain the connector, the retainer having a
14 generally annular shape.

15

16 47. The airbag module of claim 41, wherein the connector is shaped to
17 interlock nonremovably with the receptacle.

18

19 48. The airbag module of claim 41, wherein the connector comprises a main
20 body and a locking bracket movable with respect to the main body between an unlocked
21 position in which the connector is removable from the receptacle and a locked position in
22 which the connector is not removable from the receptacle.

1 49. An inflator for an airbag module for protecting an occupant of a vehicle
2 from impact, the inflator comprising:

3 a housing;
4 an initiator disposed at least partially within the housing, wherein the initiator
5 ignites in response to receipt of an activation signal; and

6 a retainer coupled to the initiator, the retainer comprising at least three splines
7 shaped to mate with at least one rib of a connector such that the connector is engageable
8 with the retainer in at least three orientations to enable conveyance of the activation
9 signal from the connector to the initiator, wherein the splines and the rib mesh to prevent
10 rotation of the connector between the orientations.

11
12 50. The inflator of claim 49, further comprising a body that encircles at least a
13 portion of the initiator, wherein the retainer is ultrasonically welded to the body.

14
15 51. The inflator of claim 50, wherein the initiator comprises a center pin, a
16 header eyelet encircling at least a portion of the center pin, a bridge wire that electrically
17 couples the center pin and the header eyelet together, a quantity of ignition material
18 positioned to ignite in response to combustion of the bridge wire, and a cup welded to the
19 header eyelet to provide a hermetic seal.

20
21 52. The inflator of claim 51, further comprising a cover attached to the body
22 to electrically insulate the initiator from the housing.

1 53. A method for connecting a connector to an inflator of an airbag module
2 for protecting an occupant of a vehicle from impact, wherein the inflator comprises a
3 receptacle having a plurality of splines and the connector has at least one rib, the method
4 comprising:

5 orienting the connector in one of at least three orientations; and

6 inserting the connector into engagement with the receptacle such that electrical
7 contact is made between the connector and the inflator and the splines of the receptacle
8 mesh with the rib of the connector to prevent rotation of the connector between the
9 orientations.

10

11 54. The method of claim 53, wherein orienting the connector comprises
12 aligning the rib with a space between the splines.

13

14 55. The method of claim 53, wherein the inflator comprises an initiator that
15 ignites in response to receipt of an activation signal, the initiator having a center pin and a
16 header eyelet, wherein the connector comprises a center opening and a peripheral contact,
17 wherein inserting the connector into engagement with the receptacle comprises disposing
18 the center pin in the center opening and disposing the peripheral contact in electrical
19 communication with the header eyelet.

20

21 56. The method of claim 53, wherein the connector comprises at least one
22 projection, wherein inserting the connector into engagement with the receptacle
23 comprises interlocking the projection with the receptacle.

1 57. The method of claim 56, wherein the projection comprises a deflectable
2 tab extending from a main body of the connector, wherein interlocking the projection
3 with the receptacle comprises nonremovably engaging the receptacle with the deflectable
4 tab.

5

6 58. The method of claim 56, wherein the connector comprises a main body, at
7 least one flexible arm extending from the main body, and a locking bracket movable with
8 respect to the main body and the flexible arm, wherein the projection comprises an
9 enlarged end of the flexible arm, wherein interlocking the projection with the receptacle
10 comprises:

11 inserting the enlarged end into the receptacle; and

12 moving the locking bracket from an unlocked position to a locked position to
13 keep the enlarged end within the receptacle until the locking bracket is moved back to the
14 unlocked position.

15

16 59. The method of claim 56, wherein the inflator comprises an initiator that
17 ignites in response to receipt of an activation signal, wherein the receptacle comprises a
18 body that encircles at least a portion of the inflator and a retainer attached to the body,
19 wherein interlocking the projection with the receptacle comprises disposing the
20 projection to abut the retainer such that the retainer retains the connector.

1 60. The method of claim 56, wherein the receptacle comprises a collar,
2 wherein interlocking the projection with the receptacle comprises disposing the
3 projection to abut the collar such that the collar retains the connector.

4

5 61. The method of claim 56, wherein the receptacle comprises a washer,
6 wherein interlocking the projection with the receptacle comprises disposing the
7 projection to abut the washer such that the washer retains the connector.

8

9 62. The method of claim 53, wherein the inflator further comprises a housing
10 and the connector comprises at least one projection, wherein inserting the connector into
11 engagement with the receptacle comprises disposing the projection to abut the housing
12 such that the housing retains the connector.

1 63. A method for manufacturing an initiation assembly for a pyrotechnic
2 device, the initiation assembly having a body and an initiator that ignites in response to
3 receipt of an activation signal, the method comprising:

4 forming a retainer having a plurality of splines;
5 attaching the body to the retainer; and
6 attaching the body to the initiator such that the body encircles at least a portion of
7 the initiator;

8 wherein after attachment of the body to the retainer and the initiator, the retainer
9 is positioned to receive a connector in any of at least three orientations to enable
10 conveyance of an activation signal from the connector to the initiator, wherein the splines
11 prevent rotation of the connector between the orientations.

12

13 64. The method of claim 63, further comprising:

14 prior to attachment of the body to the retainer, disposing the body and the retainer
15 on opposite sides of a member selected from the group consisting of a collar and a
16 portion of a housing of an inflator, the member having an opening; and

17 inserting a portion of one of the body and the retainer through the opening to
18 relatively position the body and the retainer for attachment to each other.

19

20 65. The method of claim 64, wherein the body is attached to the retainer prior
21 to attachment of the body to the initiator.

1 66. The method of claim 64, wherein the body is attached to the initiator prior
2 to attachment of the body to the retainer.

3

4 67. The method of claim 63, wherein attaching the body to the retainer
5 comprises ultrasonically welding the body to the retainer.

6

7 68. The method of claim 63, wherein attaching the body to the retainer
8 comprises attaching a cover to the body to electrically insulate the initiator from a
9 housing of an inflator.

10

11 69. The method of claim 68, wherein attaching the cover to the body
12 comprises insert molding the body around the cover and the initiator.

13

14 70. The method of claim 68, wherein attaching the cover to the body
15 comprises ultrasonically welding the cover to the body.

16

17 71. The method of claim 68, wherein attaching the cover to the body
18 comprises snapping the cover into engagement with the body.